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ABSTRACT

This paper: (1) reviews the goals and directions of United States marine education; (2) reports the findings of three surveys which were designed to provide a perspective on current Canadian efforts in marine education; and (3) presents a set of proposed goals and future directions for marine education in Canada. Federal agencies with a "functional area" related to management of marine and aquatic resources were contacted in the first survey. Individuals within these agencies completed a questionnaire pertaining to the type of K-12 involvement it had in formal education and in nonformal and information learning initiatives. Science, environmental education, or social studies consultants in the 10 provinces and two territorial ministries of education were contacted in the second survey to ascertain the extent of their involvement in marine education. Elementary and secondary teachers who had taught marine/aquatic education were contacted in the third survey to assess the status of marine education programs and to identify future directions. The results of these surveys (which are discussed separately) do not provide definitive answers. Rather, they suggest starting points, such as developing a newsletter and network to facilitate the exchange of materials and information among interested individuals. (JN)

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A Perspective on Pre-University and College Marine and Aquatic Education in Canada

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Introduction

The term "environmental education" was coined approximately fifteen years ago to emphasize the contribution that education could make to resolving environmental problems (IUCN, 1970). In a relatively short period of time in Canada, it has been very successful in promoting the values of a healthy, sustaining environment.

As a maritime nation with coasts on three seas, Canada has a special interest in the marine environment. In this year, which is the one hundredth anniversary of Heritage Conservation in Canada; the pending release of a new Parks Canada policy for marine parks; the Year of the Ocean in the United States; and the occasion of the International Congress (1986) on the World Conservation Strategy (IUCN, 1980), it is time for Canadians to step back and evaluate one important aspect of environmental education - pre-college marine and aquatic education.

Discussion for this paper is based on three surveys; the first with Canadian federal agencies; the second with provincial departments of education; and the third with a group of elementary and secondary school teachers from across Canada. The surveys were designed to assess the present state of marine education in this country and to evaluate the potential for its direction and development in Canadian school curricula. The paper begins with a review of the goals and directions of U.S. marine education, then reports on the findings of the three surveys, and concludes with a set of proposed goals and future directions for marine education* in Canada.

The American Effort

The roots of marine education in North America are diffuse, but are undoubtedly linked to the marine sciences (Keith, 1961; Abel, 1967; Brisby, 1968; Schweitzer, 1974; and Siegel, 1976). There are records in the 1900's, 1940's and early 1950's of marine research stations in the U.S. and Canada providing programs to increase local awareness of marine conservation

*Hereafter the term 'marine' will be used to connote the marine and aquatic environment .

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among pre-college students and adults (Newcombe, 1946; Huntsman Marine Laboratory, 1985: pers. comm.). The mid-sixties in the United States is designated by many as the period in which marine education really emerged. The U.S. federal government through the National Science Foundation, the Office of Education and the Sea Grant Program (PL 89-688) provided funds to "begin to stimulate youngsters' imagination with the existing phenomena of the sea". (Abel and Lindquist, 1965: 27); an uncomplicated, straight forward statement of complex multifaceted goal.

In the 60's, Hon (1969) used a grant from the Office of Education to develop a series of resource materials for teachers. These foresaw the need for an interdisciplinary approach to the study of people and marine and aquatic resources. His materials are still in use to-day in some areas of the U.S. and in several Canadian school districts. In his introduction Hon states:

> It may be as Rachel Carson moved, that it is not as important to **know** as to **feel**. The Cateret Marine Science Project may create few research biologists, but it can scarcely fail to make our clerks, salesmen and firemen of the future acutely aware of the complex marriage of land and sea. The intertwining of these two worlds is fraught with the greatest potentials and the most grievous problems.
> (Hon, 1969:1)

When the Sea Grant Program was reauthorized by the U.S. Congress in 1976 (PL 94-461), it was charged with the responsibility of:

> increasing the understanding, assessment, development, utilization and conservation of the nation's ocean and coastal resources by providing assistance to promote a strong educational base, responsive research and training activities and broad and prompt dissemination of knowledge and techniques.
> (U.S. Congress, 1976:94)

Throughout those first ten years a lot had been learned about the complexity of Sea Grant's mission. The mission statement was broadened even further between 1976-80 and 1980-83 from "essentially a science orientation to an integrative concept which included economics, history, technology, geography, mathematics, politics, sociology and law" (Fortner, 1985:1).

In 1977, the Office of Education and the National Ocean and Atmospheric Administration (NOAA) signed an agreement to co-operate in the regional development of K-12 marine education resources and seminars for teachers. This resulted in a more integrated and co-ordinated approach to marine and aquatic education programs, support services, and materials. By 1978, nearly every coastal state and several inland states had K-12 marine education materials, as well as resources for non-formal and continuing education (Goodwin and Schaadt, 1978). Some of these resource units and curriculum guides are also utilized by Canadian educators.

Defining Marine Education

To some, marine education may be restrictively interpreted as a study of limnology and oceanography in the elementary and secondary school science curriculum. However, for the work reported in this paper, the definition adopted by the U.S. Sea Grant Program was selected.

> Marine and aquatic education is that part of the total education process which enables people to develop a sensitivity to and a general understanding of the role of the **seas and freshwater** in human affairs and the impact of society on the marine and aquatic environments.
>
> (Goodwin and Schaadt, 1978)

Canadian Marine Education

To provide a perspective on current Canadian efforts in marine education we implemented three studies. First, federal agencies with a 'functional area' related to management of marine and aquatic resources were contacted. Individuals within each such agency were given an explanation of study terminology and were asked to respond to a short questionnaire pertaining to the type of K-12 involvement it had in formal education, nonformal and informal learning* initiatives.

Second, letters of enquiry were sent during the summer of 1984 to Science, Environmental Education or Social Studies consultants in the ten provincial and two territorial Ministries of Education, to ascertain the extent of their involvement in marine education. Eight provinces and the two territories responded by the end of July. Neither Prince Edward Island nor Saskatchewan participated in this portion of the project.

Finally, to quantitatively assess the status of marine education programs in elementary and secondary schools throughout Canada and identify future directions, we sampled judgements from a selected population of teachers who had taught marine and aquatic education during the previous year. Individuals who were teaching in this curriculum area for the first time were not included. Twelve such elementary and secondary school teachers were requested from each provincial and territorial government's education department.

Some provided us with no contacts, others a few and one twelve. Initially we contacted 47 teachers; 32 agreed to participate and 30 completed the three rounds of the modified Delphi process (Brown, 1968). Respondents

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*Developing and providing readily available material for use in K-12 classrooms was defined as involvement in "formal" education. "Informal" learning was defined as: "providing opportunities for individuals to acquire attitudes, values, skills and knowledge from daily experiences in the environment". (Coombs, Prosser and Ahmed, 1973:10). Whereas the third category "nonformal" learning was defined as: "organizing activities outside the established framework of the formal school and university system which aim to communicate specific ideas, knowledge, skills, attitudes and practices in response to a pre-determined need" (Waniewicz, 1976:9).

represented the ten provinces. No teachers participated from either of the territories. The sample was not randomly selected and cannot be said to be representative. It is a cross-section of opinion from classroom teachers; a start toward achieving an understanding of Canadian marine education practices.

Initially an open-ended questionnaire was used to collect teachers' opinions regarding knowledge objectives that (a) must be included, (b) should be included, (c) might be included in a K-12 marine education program. Responses from this first round were categorized by the researcher. In the second round of questioning, respondents were given those same categories and asked to rank their importance. In the final phase (third round), the educators were requested to review the same twenty statements used in the previous round, and to adjust or rerecord any of their second round replies. An additional open-ended question at the end of this questionnaire requested a rank order listing of issues they felt must be included in a marine education curriculum. Socio-demographic data were also collected in this round.

Other questions asked included: where materials utilized in their class were acquired; teacher's opinions about efficient ways to keep up with information; how teachers identified sources of information; effective methods to expand awareness among teachers about marine education; grade levels in which marine education was incorporated in the curriculum; and in which discipline it was incorporated (e.g. Environmental Education, Science, Geography, History, etc.). An attempt was made to acquire a listing of materials which respondents found most useful, but the size of the panel, the grade levels represented and curriculum areas produced a diversity of responses across the country which did not reveal any specific title or groupings of titles that one could suggest may be related to use in the classroom.

Response from Federal Agencies

Findings of the Federal agency responses, by function and department are presented in Table 1. Fisheries and Oceans, Inland Waters Directorate and the Environmental Management Services of Environment Canada were the only 'agencies' within the Federal Government developing materials for use in schools. However, it is extremely difficult to assess how adequately and effectively these materials actually reach target audiences. Teachers commented that 'source books' of ideas on 'how to do it' in the classroom and an annotated bibliography which included source, cost, level of material, focus and subject matter are not readily available. Thus a lack of awareness by teachers of these materials may account for their low levels of use.

Currently the International Joint Commission (IJC) Social and Economic Considerations Committee is attempting to identify whether or not Great Lakes ecosystem material is being taught in educational settings throughout the Great Lakes Region. Results are still being compiled (Francis, 1985: pers. comm.). The IJC is a bilateral institutional arrangement between Canada and the United States with a primary focus on water resources management.

Results of the Provincial Government Survey

Results of the letters of enquiry and questionnaires sent to consultants in provincial Ministries of Education are presented in Tables 2-5. Only Newfoundland and Labrador, Nova Scotia, and British Comumbia and the Northwest Territories had developed marine education materials for some of the grades between K-12. No province had K-12 interdisciplinary resource materials available. It should be noted that this survey did not attempt to identify local and regional initivatives, although some were indicated on teacher questionnaires.

Review of the content of the curriculum materials, (see Tables 2-5) revealed that most of the resources had been recently developed, and focused primarily on the 'science of water'. Human/resource interactions were found to be in the minority among the submitted materials. At present, Newfoundland, the Northwest Territories and Nova Scotia have produced the most materials which address man-environment relationships.

It is noteworthy that the Science Council of Canada supports the need for a more relevant and integrated approach to learning about science concepts. An article from the Science Council newsletter entitled "Does Science Reflect Real Science?" states that

> the difference between school science and real science is that the 'science' in Canadian elementary and high schools is totally devoid of context ... real science and technology happens in a context, a social, an economic and an historical context ."
>
> (In Touch, 1983: 2)

Response from Canadian Teachers

Comments from teachers (N=30) in this study are summarized in Tables 6-8. More females than males are represented among the respondents teaching Grades 3-12, with a slight majority of the classrooms from the primary and junior levels. In terms of curriculum areas represented, Science is most common, followed by Environmental Studies, and Geography. Ontario and British Columbia are overrepresented in the sample, in comparison to other areas of the country. Neither Yukon nor Northwest Territories are represented in this aspect of the study (Table 6).

When teachers were questioned concerning their contact for curriculum information, the primary source given was others teaching similar material. This was followed by information from representatives of ministries and regional education agencies, written inquiries and unsolicited mail, and conferences/professional development activities. Provincial education agencies, other provincial departments, the federal government conservation groups and the US Sea Grant agencies were identified sources of material for use in classrooms. To communicate about marine and aquatic education, teachers ranked in order of importance to them: a Newsletter, written or telephone correspondence, conference, and unsolicited mail (Table 7).

Six knowledge objectives were deemed necessary, five objectives that should be included and nine which might be included. It is interesting to note that the **science** of water was ranked much higher than human/resource interactions. Six issues of importance were developed and ranked by the study group (Table 8).

Goals and Future Directions

Based on the comments received for this project and suggestions from others, it would appear that the goal of marine education is to integrate facts, concepts, and principles about water into appropriate disciplines in school curricula, including environmental education. It should strive to become increasingly humanistic and interdisciplinary, including the social sciences, arts and humanities, as well as the traditional sciences; similar to the U.S. Sea Grant program (Fortner, 1985).

Art and theatre projects can be related to the water. Literature about the sea can enhance reading, writing and speaking skills. Mechanics of celestial navigation can serve as a lesson in Mathematics. Boyles, Charles and Daltons Laws in Physics classes can explain how humans adapt to underwater environments. Science and Economics classes can serve as forums to discuss the importance of the role of water in our daily lives. Environmental studies can provide the opportunity for students to review conflicts between and among resource users. In other words, marine education is broadly about water, both salt and fresh.

The aims of marine education should include:
(a) building an understanding of marine environmental processes;
(b) developing an understanding of the linkages between terrestrial and marine ecosystems;
(c) developing an appreciation of the relevance of marine environments to our daily lives, and an awareness of the importance of these resources to the quality of human life;
(d) increasing respect for the marine environment;
(e) encouraging people's fascination with water and arousing an interest in our distinct Canadian heritage;
(f) deepening our understanding of this environment and knowledge of specific problems, conflicts and opinions to encourage understanding of and participation in decision making processes; and
(g) enriching peoples lives through exposure to a variety of learning and leisure activities related to the marine environment.

These aims cannot be achieved through one discipline, or one curriculum area of education, or by introducing a new course, or by developing a sub-field within a discipline. Success lies in infusing marine education with environmental education into all aspects of the curriculum.

In 1980, the International Union for the Conservation of Nature and National Resources (IUCN) and the United Nations Environment Program (UNEP) released a strategy for the conservation of the earth's resources. The World Conservation Strategy (WCS) states a fundamental human problem: our continued survival and well being are dependent upon both protecting resources and using them. The ocean as a global commons is an environment which has largely escaped international co-operation in rational management to resolve this dilemma. The author of the WCS, a Canadian, and the many reviewers who participated in its evolution, feel that education about the environment must help to resolve these dilemmas. People must be encouraged to understand environmental issues they experience in their immediate environment. Their perspectives can then grown to increasingly broader global issues. In this process, understanding and knowledge can develop about how to participate in decision making which effects the environment.

The Canadian government adopted the World Conservation Strategy as a guideline for federal environmental policy in 1981 (Roberts, 1981). In 1986 Canada will host a major conference on the WCS. The earnest discussions and intensive study that will contribute to this conference offer Canadian environmental educators a unique opportunity.

What then can we expect from this conference?

It should provide a Declaration of Management Principles which ensures the right of people to live in a healthy environment. The conference should also underline the progress in environmental education and assess new challenges and unfulfilled needs. With respect to marine education, the WCS clearly states that education about the environment including the development of an awareness of the sustainable use of marine and aquatic resources is essential to the implementation of the strategy.

Finally, the conference should inspire a committment by all countries to cooperate in an expanded program to learn what each other is attempting in environmental education, including marine and adequate education. Most important, the conference planners have a unique opportunity to showcase all aspects of environmental education to Canadians and representatives from other countries.

The recent International Joint Commission initiative which attempts to regionally identify the dissemination and implementation of marine and aquatic education materials within schools, informal and non-formal settings should be expanded to include other areas of the country. Are teachers aware of materials and of methods for infusing them into curricula? What activity units, and source books are available? Who is using computer games? What audio-visual aids tend to be most effective? These types of materials, listed in a 'user friendly guide' could describe the type of material, grade level, geographic focus and subject matter as well as source and cost to acquire copies. Co-operative development of new resource units would result from increased awareness and shared input. It would also aid in identifying what is needed most by teachers, lecturers and the public.

There appears to be an 'informal network' already in existence in Canada but its extent and connections to government, public and private resources are unknown. We need to complete a nationwide analysis of this network to better define future needs and research. Instead of each province or territory doing a study of their own, a representative study of Canada could provide us with the necessary contacts and resources to create a better appreciation for the visibility of marine and aquatic environmental education.

Neither the natural scientist nor the social scientist has all the answers. Efforts should be made to broaden support for research which includes human/resource perspectives on environmental issues. Much of the material available to this study seemed to aptly and ably describe the 'science of the resource' but not the human use of our coastal resources and more importantly the human/resource interrelationships involved.

In the past, groups involved in environmental education have not been overly eager to encourage support for their efforts from the private sector.

For example, those in marine industries have a high level stake in supporting efforts to encourage resource conservation for sustainable development. Through such a cooperative effort we may be able to increase the public's awareness of the importance of environmental education and provide additional justification for needed policy. Gulf Canada's Society, Environment, Energy and Development Studies (K-12 in Alberta) is an example of cooperation that has been successful.

The data in this paper indicates that more research is needed. At present, there are several research projects underway which will contribute to development of curriculum in schools. The Whale Research Group of Memorial University of Newfoundland has recently completed a survey of knowledge and attitudes towards the marine environment among 7,000 school children and their teachers. Several researchers are preparing discussion papers on the need for marine education in Canada, curriculum development and related case studies and a curriculum plan.

Progress is underway. The surveys in this project do not provide definitive answers, rather they suggest a series of possible starting points:

(1) The federal government should develop an "accountability centre" for those departments with a water resources management function currently involved in formal, informal and nonformal education and learning. This centre would co-ordinate development of teacher resources (e.g. guides, annotated bibliographies, sources and costs) and support development of regional resource materials for K-12.

(2) Provincial Ministries of Education should support development of 'local issue' resources and inform teachers of the availability of not only their resources but those developed by other levels of government, universities, agencies and individuals.

(3) A 'newsletter and network' of interested people in Canada should be developed to facilitate the exchange of materials and information. (e.g. "All Wet" - included with this paper).

(4) Matching federal-provincial funds should be made available for representatives from all levels of education to attend and participate in the World Congress on the World Conservation Strategy in 1986.

(5) Teachers should be encouraged through workshops and teacher bulletins to infuse marine education in the disciplines in which they teach to broaden the impact of marine and environmental education in the primary, junior, and secondary school systems.

The goal of this paper is to provide a starting point for a thorough examination of the state of Canadian marine education; it is designed to stimulate readers toward comment and additional study. This process can then serve as a basis for understanding and wisely directing future developments toward better marine education in Canada.

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Thanks are extended to representatives of Provincial and Federal Departments who willingly donated their time to the survey and willingly followed up on numerous telephone calls. The panel of 30 teachers who persisted throughout three rounds of questionnaires are acknowledged for their suggestions and patience. The Department of Employment and Immigration provided a 'summer works project' for two undergraduate students to support the initial phase of the work during 1984; the staff of Parks Canada, Ottawa should be recognized for their interest and comments about this research and finally Dr. Jon Lien and Heather Walter for their perceptive comments and advice.

Table 1. The Federal Government and Marine Education

Functional Area	Agency	Formal	In-formal	Non-formal
I. Environmental Protection . Pollution Control	Environment Canada	No	Yes	Yes
II. Renewable Resource Management				
. Management of Water Resources	. Inland Waters Directorate	Yes	Yes	Yes
	. Environmental Mgt. Service*	Yes	Yes	Yes
. Management of Fisheries	Fisheries & Oceans	Yes	Yes	Yes
. Wildlife Management	Canadian Wildlife Service*	No	Yes	No
. Forest Management	. Canadian Forestry Service* . Environmental Mgt Service*	Yes	Yes	Yes
. Agriculture	Department of Agriculture	No	No	No
. Parks	Parks Canada*	No	Yes	No
(Note: *Co-operated on an Environment Education Kit which focuses on Freshwater)				
III. Non-Renewable Resource Management				
. Land Based Mineral Development	Energy Mines and Resources	No	Yes	No
. Dredge and Fill	Ministry of Transport	No	Yes	No
. Offshore resources	Energy Mines and Resources	No	Yes	No
IV. Industrial Development and Transportation				
. Development	Regional and Economic Expansion	No	Yes	Yes
. Ports Administration	Harbours Board, Transport, Small Craft	No	Yes	Yes
. Transportation	Department of Transport	No	Yes	Yes

Table 2. Provincial Education Agencies Involvement in Marine and Aquatic Education Eastern Canada 1,2,3

Province	Level	Theme of Material	Selected Comments
Newfoundland and Labrador	1	Water and Ice (Science, 1984) Shells (Science, 1984)	"Many of our programs in Science K-12 have a marine component... we have not developed any programs specific to Marine and/or Aquatic Education
	3	Communities of Living Things: A Seashore Community (Science, 1984)	
	4	Water and the Land (Science, 1984) Ocean and Freshwater Environment (Science, 1984)	
	5	Conflict (Getting Along: Fish, Whales and Fishermen, 1984)	
	7	An Ecology Unit on Freshwater Ecosystems	
	10-12	Physical Science 2205 Water Environmental Science 2203 Hydrologic Cycles Cycles (Earth Science Curriculum Guide, 1983)	
		Environmental Science 3205 Aquatic Environments and Acid Rain Marine Environments and Resource Management (Cod, Oil, Herring, Arctic Char) Global concern for Oceans	

1. Note Tables 2-5 summarizes responses from individual Science Consultants, Social Studies Consultants, Executive Directors, Executive Assistants or Assistant Directors employed within Provincial and Territorial Ministries or Departments of Education. There are numerous local and regional initiatives not documented in this research (Ewert, L. 1984).
2. Committee of Atlantic Environment Ministers 1978. Our Coastal Environment. A cooperatively produced resource for teachers and the public.
3. Prince Edward Island and Saskatchewan education agency representatives did not respond in writing to the survey

Rable 2a. Provincial Education Agencies Involvement in Marine and Aquatic Education Eastern Canada [1]

Province	Level	Theme of Material	Selected Comments
Nova Scotia[2]	Primary and Junior	Water and Oceans	Most important marine education course is Oceanography 331... taught for 15 years...some 30 high schools in province use it.
	10	Biology Course: Ecology of Shorezones	
	9-12	Oceanography 331	
New Brunswick	Elementary and Junior 9-12	Water (physical and biological system)	...little in our curriculum concerning marine education...some teachers at the school level may include material in their science courses at elementary and junior high levels; however, that is their choice
	9-12	Environmental Studies 112 and and 113 Geography 112	
	(Andrews, W.A. 1975. Contours Series: Freshwater and Marine Ecology)		

1. See Footnote Table 2.
2. Nova Scotia Museum has material prepared on various types of beaches in this province so that teachers can develop units in their specific areas.

Table 3. Provincial Education Agencies Involvement In Marine and Aquatic Education Central Canada[1]

Province	Level	Theme of Material	Selected Comments
Quebec	Elementaire	Water as a physical system and biological community	We do not have a specific program for these subjects (Marine and Aquatic Education)
	Secondaire	Physical, Chemical, Biological systems of water	
Ontario[2]	K-3 Primary	Environmental Studies, Science, Social Studies (Water: extent and use and biological community)	There are few specific references in Ontario curriculum guidelines to the topic (marine education)...current curriculum guideline for Senior Division (Physical Geography) there is a unit on water...course is optional for diploma purposes
	4-6 Junior		
	4-6 Junior	Environmental Studies, Science	
	7-8 (9)	Environmental Studies, Science	
	9(10)-12/13	Geography, Science, (Chemical Medium, Biological Community, threatened resource)	

1. See Footnote Table 2.
2. It is in Ontario that there seems to be numerous local, regional, and individually prepared resource units on water for teachers, the content of which is unknown.

Table 4. Provincial Education Agencies Involvement In Marine and Aquatic Education The Prairies[1,2]

Province	Level	Themes of Material	Selected Comments
Manitoba	Elementary	Science (physical system biological community, scarce resource)	There may be elements of marine education in our science curricula, there is no specific unit that I can send you.
	Secondary	Science (chemical medium physical system and biological community)	
Alberta	Elementary	Science, Environmental Studies (physical system, biological community, scarce resource)	There are no programs specifically focusing on marine education and marine environments.
	Secondary	Science, Geography (physical system, biological community, scarce resource)	.
British Columbia[3]	3	Communities of Living Things	The science course of studies contain units related directly to marine education; nonetheless they allow for flexibility at the local level for development of resources.
	4	Animals and Their Environment	
	6	Changing and Preserving Our Environment Plant and Animal Life Cycles and Eco System Earth Ecology: Interactions in the Environment	
	10	Environmental Science	

1. See Footnote Table 2.
2. Saskatchewan did not respond to the written survey.
3. The Junior section is under revision and new titles and resources are now used.

Table 5. Territorial Education Agencies Involvement in Marine and Aquatic Education Northwest Territories and Yukon[1]

Territory	Level	Theme of Material	Selected Comments
Northwest Territories	3	Marine Mammals (1985) Fish (1985)	...Language development unit on marine mammals, fish unit for science
	7-9	Physical properties of water, northern ecosystems, marine and freshwater ecosystems, oil and the Arctic Northern Environmental Problems (1984)	Current problems and technology associated with offshore drilling rigs, ice breakers, artificial islands and the Arctic Pilot Project...new material (84) is only offered in three schools in 1984.
	High School	Science 35 (1984) studies marine area tides, currents, drift patterns of ice, natural history, economics, seals, whales, char, walrus, narwhale and fish.	
Yukon[2]			Yukon schools utilize B.C. public school curricula and course guides.

1. See Footnote Table 2.
2. See Table 4 for details on B.C. curricula.

Table 6. Composition of Delphi Panel of School Educators

Sex		Grade Level(s) Taught and Class Designation			Geographic Representation	
Male	12	Grade	Class Designation	N [2]	Newfoundland	1
Female	18	3	Environmental Studies	1	P.E.I.	1
		4	Environmental Studies, Science	2	Nova Scotia	3
		5	Environmental Studies	1	New Brunswick	2
		6	Environmental Studies, Science	1	Quebec	2
		7	Environmental Studies, Science	2	Ontario	9
		8	Environmental Studies, Science	4	Manitoba	2
		9	Geography, Science	6	Saskatchewan	1
		10	Biology, Science	2	Alberta	1
		11	Science, Environmental Studies	3	B.C.	8
		12	Science, Geography	3	Yukon	0
					NWT	0

1. The respondent was requested to designate the grade level(s) in which they taught marine and/or aquatic education in 1984.
2. Note four teachers at the primary and junior level taught more than one grade (n_1=16) and one teacher at the secondary level taught more than one grade (n_2=14).

Table 7. Rank Order Importance of Source of Information for Marine and Aquatic Education Materials

Who	Where	Best Way to Communicate
1. Others Teaching Similar Material	1. Provincial Education Agencies	1. Newsletter
2. Ministry of Education and Consultants	2. Other Provincial Agencies	2. Written or Telephone Inquiry
3. Written Inquiries and Unsolicited Mail	3. Federal Departments	3. Conferences/Workshops
4. Conferences/Professional	4a. Conservation Groups/ Organizations	4. Unsolicited Mail
	4b. U.S. Sea Grant	

Table 8. Knowledge Objectives and Issues for Marine and Aquatic Education (K-12

Knowledge Objectives That Must be Included	Rank Order of Importance and Issues
Nature of Water (Role, Distribution and Use)	1. Pollution (Hazardous Wastes)
Effect of Water on Weather and Climate	2. Fish and Fisheries
Life in Rivers, Lakes, Oceans, and on Shorelines	3. Acid Rain
Resource Development and Habitat Preservation (Role of Governments)	4. Conservation
Properties of Water	5. Estuaries and Wetlands
How Water Moves	6. Wildlife
Knowledge Objectives That Should Be Included	
Food Resources of Rivers, Lakes and Oceans	
Mineral Resources of Rivers, Lakes and Oceans	
Conservation of Water	
Water Column, Bottom and Shore Processes	
Chemistry of Rivers, Lakes and Oceans	
Knowledge Objectives That Might Be Included	
Economics	
Global Role of Large Bodies of Water	
Transportation	
Shipbuilding	
Heritage and Cultural Resources	
Safety	
Harbours	
Energy and Lakes, Rivers and Oceans	
Recreation and Water	

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